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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2017 is also published.

INTRODUCTION

The Technical Faculty "Mihajlo Pupin", Zrenjanin, of the University of Novi Sad, the Republic of Serbia organizes VIIIth International Scientific Professional Conference "Information Technologies and Development of Education 2017" (ITRO 2017). The Conference will be held on 22nd June 2017 at the Technical Faculty "Mihajlo Pupin" in Zrenjanin, Serbia.

The Conference "Information Technologies and Development of Education 2017" (ITRO 2017) is organized due to the needs to connect science, profession and education through topics and content concept, first of all concerning the teaching process as base of information society. The tendencies of developed countries are in accordance with the efforts of UNESCO to improve this area related to the needs of life and work in the XXIst century. It is necessary to assess the state, detect the problems and perspectives of the development of education by competent professionals and teachers as well as the influence of the development of education on the development of the society as a whole.

The central topic of the meeting is the model of dual education as base for creating good base for the development of industry. Thus, our aim is to gather the representative entities who are able constructively contribute to establishing link between the educational system and industry as follows: Chamber of Commerce of Serbia – Centre for Dual Education, Ministry of Education, Science and Technological Development, Union of Employers of Serbia, ZREPOK – Business Organization of Zrenjanin and Companies that run their business in the region, directors of grammar schools and secondary vocational school, members of the academic communities and other participants who are interested in the topics.

The main topics of the scientific professional conference are:

- Model of dual education
- Teaching based on the concept of entrepreneurship

Other thematic areas of the Conference:

- Theoretical and methodological questions of contemporary Pedagogy
- Digital didactics media
- Contemporary communication in teaching
- Curriculum of contemporary teaching
- Developing teaching
- E-learning
- Management in Education
- Teaching methods of natural and technical subjects
- Information-communication technologies

The Chairman of the Organizing Committee of the ITRO 2017 Prof. Dragana Glušac opened the Conference. The participants were addressed by the vice dean of the Technical Faculty »Mihajlo Pupin«, Prof. Dijana Karuović; provincial secretary for science, higher education and scientific Research prof. Zoran Milošević, and the vice-major of Zrenjanin Mr. Dusko Radisic.

There were total of 143 authors that took part at the Conference from 12 countries, 2 continents: 82 from the Republic of Serbia and 61 from foreign countries such as: Macedonia, Bulgaria, Slovakia, Austria, Cyprus, Albania, Hungary, Spain, Bosnia and Herzegovina, USA, Portugal.

The Proceedings of papers contains 60 papers and it has been published in the English language.

President of the Organizing Committee
Prof. dr Dragana Glusac

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CONTENTS

Exploring Educational Dilemmas Using the System Dynamics and Archetypes

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Abstract - This article describes how the systems archetype 'Drifting Goals' can be used in the classroom to explore ethical dilemmas. Systems archetypes are systems thinking tool that provide a framework that shifts the focus from seeing ethical dilemmas as stemming from the acts of individuals to a focus on the systemic interrelationships and interactions within the organization. The use of the 'Drifting Goals' archetype provides a pedagogical approach that exposes students to innovative ways of thinking about ethical problems and the structures that create them.

A common approach to teaching business ethics is to give students case studies of "ethical themes" or ethical breaches in workplaces and organizations. As is appropriate in the study of ethics or education, these focuses on individual values and decision making. The rationale for this approach is that this will give students the tools for improved ethical behavior in the workplace. Essentially it is a focus on the role of the individual in business ethics and the assumption underlying this approach is that educating individuals to be ethical will lead to ethical behavior in the workplace. An additional strategy is to develop and explore the structural and systemic factors that lead to ethical breaches. This approach explores the tension between the role of the individual and the role of organizational structure in determining behavior.

I. INTRODUCTION

This paper proposes a definition of systems thinking for use in a wide variety of disciplines, with particular emphasis on the development and assessment of systems thinking educational efforts. The definition was derived from a review of the systems thinking literature combined with the application of systems thinking to itself. Many different definitions of systems thinking can be found throughout the systems community, but key components of a singular definition can be distilled from the literature. This researcher considered these components both individually and holistically, then proposed a new definition of systems thinking that integrates these components as a system. The definition was tested for fidelity against a System Test and against three widely accepted system archetypes. Systems thinking is widely believed to be critical in handling the complexity facing the world in the coming decades; however, it still resides in the educational margins. In order for this important skill to receive mainstream educational attention, a complete definition is required. Such a definition has not yet been established. This research is an attempt to rectify this deficiency by providing such a definition.

The System Test, shown in Figure 1, was devised as a means by which to test a system thinking definition for systemic fidelity. The test is relatively simple. Each definition will be examined to determine if it contains these three things:

1. Function, purpose, or goal. This should describe the purpose of systems thinking in a way that can be clearly understood and relates to everyday life.

2. Elements. These elements will manifest as characteristics of systems thinking.

3. Interconnections. This is the way the elements or characteristics feed into and relate to each other.

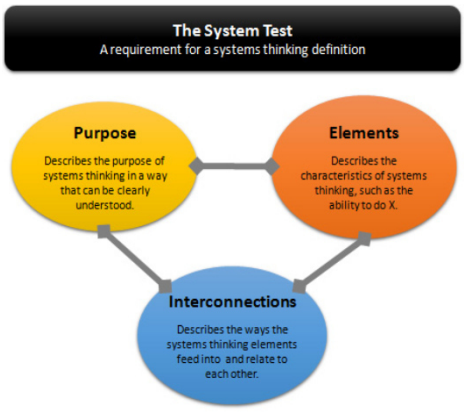

Figure 1. The System Test

Of course, the simple fact that a definition describes systems thinking as a system does not necessarily mean it is a correct definition. However, the System Test should be considered as a necessary, but not sufficient set of criteria for a system thinking definition to be considered complete.

II. SYSTEM THINKING

Jay Forrester's definition was: "As a contrast to the discussion on what systems thinking is, it is important to consider one example of what systems thinking is not". Jay Forrester, known as the founder of System Dynamics, presents just such a definition. Even though he uses the term systems thinking" differently, or perhaps because he does, his definition should be considered in order to comprehensively discuss systems thinking. He writes (1994): "Systems thinking" has no clear definition or usage. Some use systems thinking to mean the same as system dynamics. "Systems thinking" is coming to mean little more than thinking about systems, talking about systems, and acknowledging that systems are important. In other words, systems thinking implies a rather general and superficial awareness of systems. The systems thinking that Jay Forrester is writing about here is not our systems thinking. He appears to be using the term in a different way. However, note Dr. Forrester's assertion that systems thinking has no clear definition or usage – this again reinforces the need for a complete, widely accepted definition.

It is important for students to discover that in fact or fiction "the more things change, the more they stay the same." It is important for students to relate present events to the patterns of behavior created by a particular sequence of events. It is important for students to reason that these patterns of behavior show-up repeatedly, therefore outcomes might be predictable and leverage points for change could be recognized and developed. It is important for students to connect ideas, to find one truth in the light of another, and to develop a broad foundation for the depth of knowledge to be acquired. The desired results for the students are that they learn to relate sequences of events to patterns of behavior, they learn to detect the operating structure of a system, they learn to recognize archetypes of systems, they learn to recognize causal loops operating in systems, and they learn to understand the process by which actions are prompted by beliefs "which are based on conclusions inferred from observations plus experiences." (adapted from Fifth Discipline Field Book, p.242, Rick Ross)

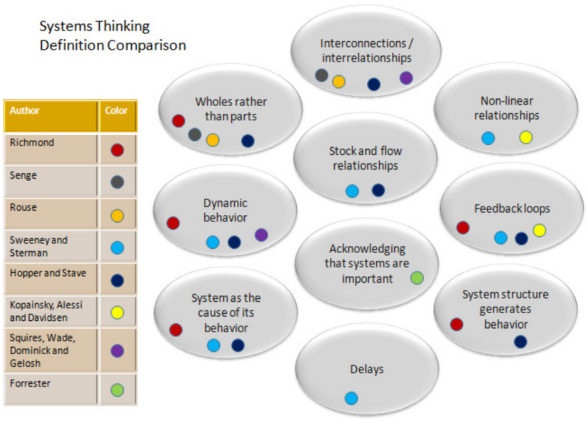

Figure 2. The System Thinking

III. DRIFTING GOAL ARCHETYPE

Systems archetypes are system thinking tool that provide a framework that shifts the focus from seeing educational or ethical dilemmas as stemming from the acts of individuals to a focus on the systemic interrelationships and interactions within the organization. The use of the 'Drifting Goals' archetype provides a pedagogical approach that exposes students to new ways of thinking about ethical problems and the structures that create them.

Systems archetypes are a particular type of systems thinking tool that provide a visual illustration of the common challenges that occur in all kinds of industries and organizations. When organizations are faced with the same types of problems recurring then there is likely to be a systems archetype operating in the background. In the Fifth Discipline, Senge (1990) identified eight archetypes which he believed constitute consistent patterns of behavior in organizations. Kim (1990) defined systems archetypes as a set of common dynamics that recur in many different situations. The use of the archetypes can assist students in identifying common systems behaviors that may fit into one of these recurring patterns (Kim, 1990).

The drifting goals archetype is a visual tool that can provide a vehicle for students to understand the interrelationships and patterns of change that often form the basis of ethical dilemmas and erosion of ethical standards. The emphasis with this systems archetype is developing an understanding of the dynamics of behavior over time. In other words, it allows a focus on the ongoing rather than immediate effects of ethical dilemmas. Ethical standards operating in organizations can diminish over time and the "Drifting Goals Archetype" provides a basis for

understanding the dynamics of why this is likely to occur.

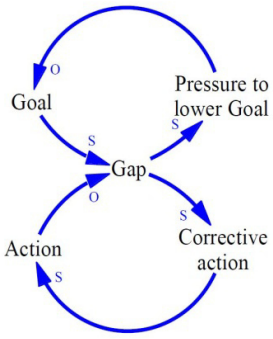

Figure 3. The Drifting goal Archetype

In a drifting goals archetype, a gap between the goal and current reality can be resolved by taking corrective action or lowering the goal. The critical difference is that lowering the goal immediately closes the gap, whereas corrective actions usually take time. The second half of the Drifting Goals archetype is added in Figure 3.

Now the increase in the gap is met by corrective action (a change in policy, procedure or structure) and new action or behavior closes the gap, in some way other than eroding the goals or standards. The underlying dynamics of this archetype are that a company finds there is a gap between standards they aspire to and some set of new demands. A simple example of this is dropping quality standards to meet tight deadlines. The lowered standard can become the accepted standard and with each cycle through the loop, the standard drops again. The 'quick fix' is to lower standards to meet the pressures. This in turn makes it easier to lower the goal or standard next time. This cycle is also an excellent example of behavior over time being driven by system structure. The longer term, and often more difficult, solution involves making fundamental changes that maintain standards and meet the new demands. However, the longer-term solution involves a lag between the corrective action and the new performance at the desired standard (Kim, 1992).

IV. CONCLUSION

The ability of our world's citizens to perform effective systems thinking is extremely important to the world's future. The use of systems thinking transcends many disciplines, supporting and connecting them in unintuitive but highly impactful ways. Thus far, the systems thinking skill set has remained on educational margins for a variety of reasons. One of these reasons is the absence of a widely accepted, complete definition of systems thinking. Proposed in this paper is such a definition. The proposed definition passes a System Test, confirming its systemic fidelity. The definition includes a clear goal, elements of systems thinking, and descriptions of interconnections between these elements. The definition synthesizes the most common and critical systems thinking competencies discussed in the literature. Moving forward, this definition can be used for systems thinking educational efforts, systems science, and a myriad other discipline which require the use of critical systems understanding and intuition.

The drifting goals archetype is best used in conjunction with a wide range of teaching techniques. A fundamental tenet of systems thinking is the provision of multiple perspectives on any given problem. As we have said, some students get more insights using these techniques than others. Some are more comfortable with traditional organizational behavior instructional approaches but the use of archetypes does help explore issues from an alternative paradigm. The drifting goals archetype is useful in explaining situations educational or ethical dilemmas where key causalities can be identified and where it is important to identify long-term behavioral implications of management decisions. In this context, systems thinking lends itself to case studies and discussions of situations where recurring patterns of ethical dilemmas are likely to be present.

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